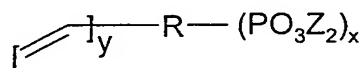


## Claims

1. Proton-conducting electrolyte membrane obtainable by a method consisting of the following steps:
  - A) expanding a polymer film with a liquid that contains a vinyl-containing phosphonic acid, and
  - B) polymerisation of the vinyl-containing phosphonic acid present in the liquid introduced in step A).
2. Membrane according to claim 1, characterised in that the film used in step A) has an expansion of at least 3% in the liquid containing vinyl-containing phosphonic acid.
3. Membrane according to claim 1, characterised in that the polymers used in step A) are high-temperature stable polymers which contain at least one nitrogen, oxygen and/or sulphur atom in one or a number of recurring units.
4. Membrane according to claim 1, characterised in that the liquid containing the vinyl-containing phosphonic acid contains compounds of the formula



in which

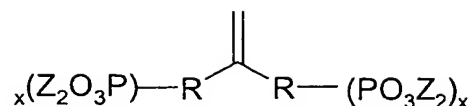
R denotes a bond, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub>

Z independently of each other denotes hydrogen, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub> and

x denotes a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10

y denotes a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10

and/or the formula

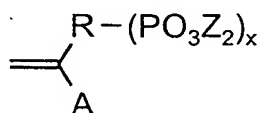


in which

R denotes a bond, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub>

Z independently of each other denotes hydrogen, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub> and

x denotes a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, and/or the formula



in which

A represents a group of formula COOR<sup>2</sup>, CN, CONR<sup>2</sup><sub>2</sub>, OR<sup>2</sup> and/or R<sup>2</sup>, in which R<sup>2</sup> denotes hydrogen, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub>,

R denotes a bond, a bivalent C1-C15-alkylene group, bivalent C1-C15-alkyleneoxy group, for example an ethyleneoxy group or bivalent C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub>,

Z independently each other denotes hydrogen, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub> and

x denotes a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10,

5. Membrane according to claim 1, characterised in that the liquid containing the vinyl-containing phosphonic acid contains monomers that are capable of cross-linking.

6. Membrane according to claim 1, characterised in that the liquid containing the vinyl-containing phosphonic acid contains at least one substance that is capable of radical formation.
- 5 7. Membrane according to claim 1, characterised in that the polymerisation according to step C) takes place by irradiation with IR or NIR light, UV light,  $\beta$ -,  $\gamma$ - and/or electron radiation.
- 10 8. Membrane according to claim 1, characterised in that the membrane has an intrinsic conductivity of at least 0.001 S/cm.
- 15 9. Membrane according to claim 1, characterised in that the membrane contains between 0.5 and 97% by weight of polymer and between 99.5 and 3% by weight polyvinylphosphonic acid.
- 20 10. Membrane according to claim 1, characterised in that the membrane has a layer containing a catalytically active component.
11. Membrane-electrode assembly containing at least an electrode and at least a membrane according to one or more of claims 1 to 10.
12. Fuel cell containing one or more membrane-electrode assemblies according to claim 11 and/or one or more membranes according to any of claims 1 to 10.